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Fish Stocking Assessment of Pothole (43 Mile) Lake, 2001

R. J. Zemlak and D. M. Cowie

January 2004

PWFWCP Report No. 284

The Peace/Williston Fish & Wildlife Compensation Program is a cooperative venture of BC Hydro and the provincial fish and wildlife management agencies, supported by funding from BC Hydro. The Program was established to enhance and protect fish and wildlife resources affected by the construction of the W.A.C. Bennett and Peace Canyon dams on the Peace River, and the subsequent creation of the Williston and Dinosaur Reservoirs.

Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave. 3rd Floor, Prince George B.C. V2L 3H9

Website: *www.bchydro.com/pwcp/*

This report has been approved by the Peace/Williston Fish and Wildlife Compensation Program Fish Technical Committee.

Citation: Zemlak, R.J. and D.M. Cowie. 2004. Fish stocking assessment of Pothole (43 Mile) Lake, 2001. Peace/Williston Fish and Wildlife Compensation Program Report No. 284. 14pp plus appendices.

Author(s): Randy J. Zemlak[1] and Dawn M. Cowie[1]
Address(es): [1] Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave., 3rd Floor, Prince George, B.C. V2L 3H9

Pothole (43 Mile) Lake

WATERSHED:	Parsnip River
DATE OF SURVEY:	September 24 and 25, 2001
FIELD CREW LEADER:	Randy J. Zemlak
FIELD ASSISSTANT:	Arne R. Langston

PEACE/WILLISTON FISH AND WILDLIFE COMPENSATION PROGRAM

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GENERATION

and

MINISTRY OF WATER, LAND and AIR PROTECTION

ENVIRONMENTAL STEWARDSHIP DIVISION

REPORT PREPARED BY: RANDY J. ZEMLAK
DAWN M. COWIE

Lake: **Pothole (43 Mile) Lake**

INTRODUCTION

Pothole (43 Mile) Lake, located near Mackenzie BC (Figure 1), is a small kettle lake off of the Six Mile Bay Recreation Road. This lake has been researched for a number of years. A brief lake inventory was conducted in 1979 (Anonymous 1979). Very little information was collected on the lake habitat and species present at that time. During the next year, the lake was deemed suitable for fish introductions. After 6 stocking cycles, a more formal standard fisheries baseline reconnaissance level survey of Pothole Lake was conducted by the Peace/Williston Fish and Wildlife Compensation Program (PWFWCP). The status of the current fish population and recommendations for future enhancements were provided to BC Environment (Jesson 1989). All of the above reports can be viewed at the PWFWCP office.

During September 2001, PWFWCP fish biologists re-investigated Pothole Lake primarily to evaluate the success of the current fish stocking program and to determine if changes to the stocking program were required.

LAKE LOCATION

Location:	38.9 km north/northeast of Mackenzie BC
Elevation:	± 693 m
Latitude/Longitude:	55° 35' 44" : 123° 22' 40"
U.T.M.:	10.0476193.6161132 (NAD 1983)
Management Unit:	7-30
N.T.S. Map No.:	93 - O/11
Watershed:	Parsnip River
Waterbody Identifier:	00357PARA
Lake Drainage:	closed system

ACCESS

Although access to Pothole Lake has not changed significantly since the original reconnaissance level lake inventory (1989), exact road directions and conditions may have changed over time. From the Alexander Mackenzie Hotel in Mackenzie (0.0 km), drive north on the Mackenzie Boulevard/Finlay Forks Forest Service Road. At 0.4 km, drive straight through the 4 way intersection. At 7.5 km, the road changes from a two lane paved road to a two lane gravel (2wd) road. At 9.5 km, there is a four way intersection. Stay straight on the Parsnip West Forest Service Road. At 10.4 km, stay right at this three way intersection. At 19.7 km, go straight (do not go right on the Tony Creek main line road). At 41.1 km turn left onto the Six Mile Bay recreation Site Road. Continue straight for 0.4 km and turn left onto an unnamed road. Drive 0.5 km to the access trail head location and parking area (UTM 10.0475816.6160865). From the parking area, walk down the steep access trail approximately 170 m to the lake.

Lake: **Pothole (43 Mile) Lake**

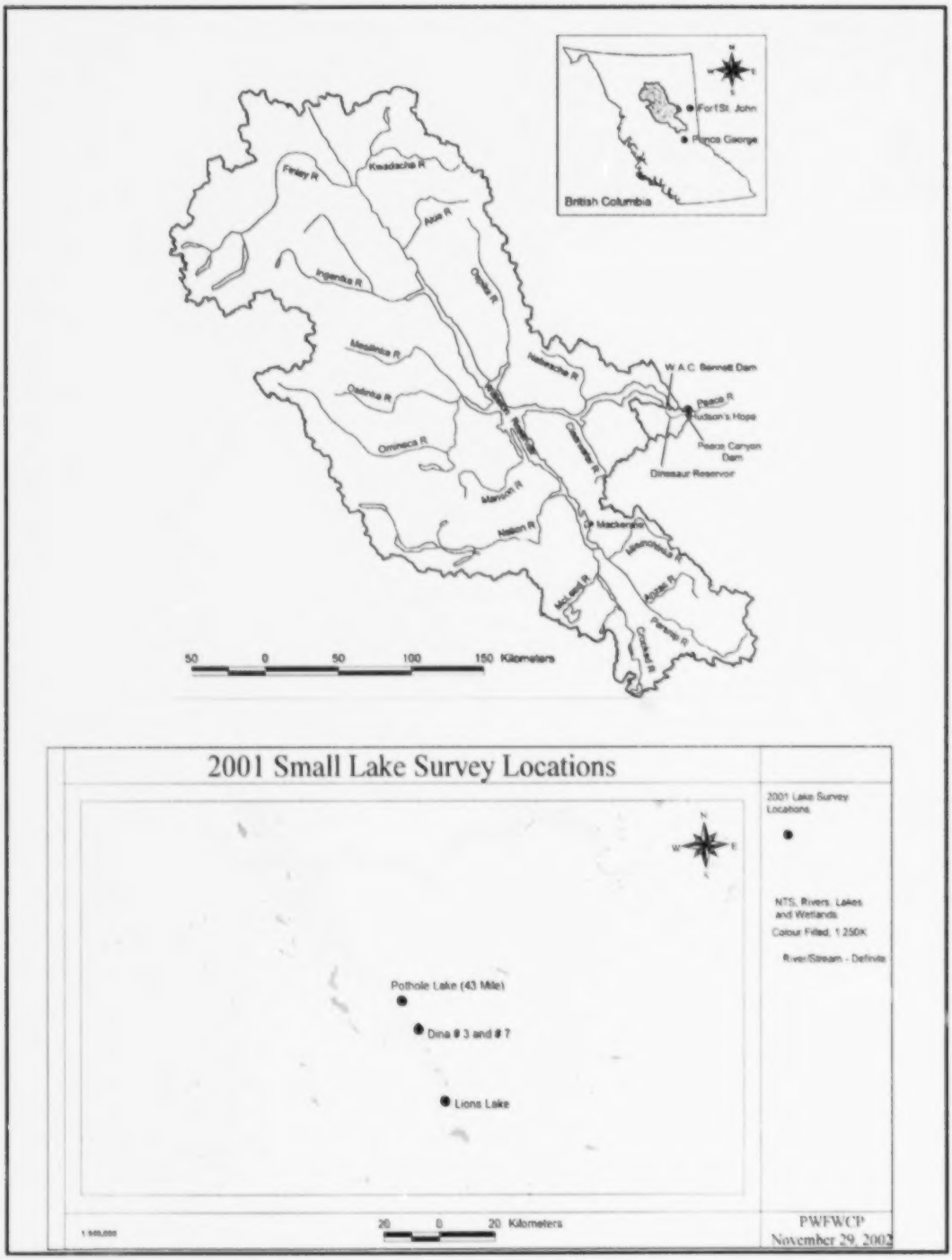

Figure 1. Location of Pothole (43 Mile) Lake.

Lake: **Pothole (43 Mile) Lake**

STOCKING HISTORY

Rainbow Trout

Pothole Lake was initially stocked with 10,000 rainbow trout in 1980 (Table 1). Stocking numbers were initially high (to get the lake started), and have now decrease over time. Currently, the lake is being stocked bi-annually with 1,500 yearlings (since 1995).

Table 1. Pothole Lake rainbow trout stocking history.

Year	Number	Size (g)	Life Stage	Stock
1980	10,000	6.3	UN	Badger
1981	5,000	5.7	UN	NRT Premier
1982	5,000	4.0	UN	NRT Premier
1983	5,000	4.0	UN	NRT Premier
1985	2,500	0.8	UN	NRT Premier
1987	2,500	12.8	UN	NRT Premier
1989	2,500	10.4	YE	Tunkwa
1990	2,500	16.6	YE	Tunkwa
1991	2,500	5.1	YE	Badger
1993	2,500	2.9	YE	NRT Premier
1995	1,500	18.5	YE	Pennask AF
1997	1,500	17.1	YE	Pennask Hath AF
1999	1,500	15.2	YE	Pennask Beav AF
2001	1,500	12.7	YE	Pennask BV AF

Originally, natural rainbow trout were stocked. Between 1993 and 1995, the stock of fish was changed to all female fish. The reason for this change was that the single female fish had a higher survival rate when put in a system like Pothole (i.e. no available spawning). Therefore, less fish would be required to stock the lake and the extra fish could be put towards another system in the area.

METHODS

Three different techniques were used to determine relative abundance of fish species in Pothole Lake. Conversations with Ministry of Water, Land and Air Protection (MWLAP) fish biologists prior to the gill netting effort suggested that it would be valuable to have at least 10 fish sampled from each age group to accurately provide future recommendations to the stocking program. Therefore, it may have been deemed necessary to keep the nets in the water overnight. Two sinking monofilament experimental gill nets were set to capture fish. Net one consisted of six different sized mesh panels ranging from 25 to 85 mm. Each panel is 15.24 m long and 2.4 m wide. This net was set twice, with the first set remaining over night and the second during the day. The second net was a single panel gill net, 19 mm stretch mesh, 15.24 m long and 2.4 m wide and was set overnight.

The second method used was Gee traps. Each Gee trap (two in total) was baited with sardines and set overnight. The Gee traps were set in shallow (< 2 m) littoral habitat. The third technique used to capture fish was angling gear. A spin cast rod with an assortment of lures and a fly rod with dry flies were utilised. Angling efforts by Program biologists were recorded to determine catch per unit effort (CPUE).

Captured rainbow trout were measured for fork length (mm) and weight (g). A biological examination of the fish was conducted which revealed it's sex, maturity, stomach contents, and disease/parasite presence. Scale samples were collected for age determination and analysis was performed by North/South Consultants (NSC). General appearance of the fish was recorded through visual analysis. Photos of fish were taken. Mean lengths and weights were determined for each age class of rainbow trout. Condition factors ($\text{Weight(g)/Length(cm)}^3 \times 100$) were determined for each individual fish and each age class.

Non-game species were also enumerated and sampled for fork length and weight. General appearance of these fish was observed and recorded. Any non-game fish captured that were still alive in the gill nets were released immediately.

The habitat features of Pothole Lake were briefly assessed. The entire perimeter of the lake was observed to confirm the lack of any inlets or an outlet stream. The benchmark set during the original study (1989) was located. Changes to the current lake level was measured with an Abney level, 1.5 m staff, and a 30 m Eslon tape. Any new campsites and other developments identified after the original survey in 1989 were also recorded. Photo documentation was taken of the lake habitat but is not presented in this report.

A limnology station was established to profile the water temperature and dissolved oxygen at varying depths. A YSI model 58 O_2/Temp. meter was used for the limnological profile.

RESULTS

Of the three methods used to capture fish in Pothole Lake, gill nets and Gee Traps were the methods that produced fish (Table 2). No fish were captured by angling.

Table 2. Lake catch summary for Pothole Lake, 2001.

Date	Species	Net Set Number			Gee Traps		Angled	Total Sampled	Size Range
		1	2	3	1	2			(cm)
Sept. 24	none						0	0	-
Sept. 25	RB	X						18	12.5 – 44.7
Sept. 25	LKC	X						17	10.5 – 12.0
Sept. 25	none		X					0	-
Sept. 25	RB			X				7	54.8 – 44.5
Sept. 25	none				X			0	-
Sept. 25	RB					X		1	12.0
Sept. 25	LKC					X		29	4.8 – 9.0

Gill Nets

Three gill net sets were conducted on September 24 and 25 (Figure 2), with sets #1 and #2 remaining overnight. Set #1 (six panel net) was set for a total of 24.25 hours and produced 18 rainbow trout (CPUE = 0.74 trout / hour) and 17 lake chub. Set #2 (one panel net) was set for 17.6 hours and produced 0 fish. Set #3 (six panel net) was set for 4.5 hours throughout the day and yielded 7 rainbow trout (CPUE = 1.5 trout / hour). The nets were checked periodically throughout the day to avoid capturing too many fish.

All 26 rainbow trout were sampled for stomach content, measured for length and weight, and scale samples taken for age analysis (Appendix 1). From the field observations, there appears to be three maturity levels present: immature (1 year olds), maturing (3 year olds), and spawnbound (3-5 year olds). Of the 26 fish captured, 3 were mature females with ripe eggs, 1 red male (presumed spent), 1 spent female, 18 were maturing, and 3 were immature. Most of the rainbow trout captured were age class 5 fish (15 of 26).

Ageing of fish in Pothole Lake proved to be inconsistent among readers. Age determination for all of the rainbow trout was determined by NSC (Appendix 2). Prints of the scales and age markings were provided for each fish, and reviewed by Program biologists. Many scales were lacking an annulus and could ultimately underestimate the final ages. This problem has also been noted by Lentsch and Griffith (1987). It was then determined that 15 of the ages were deemed incorrect from the NSC analyses. Since the lake has been stocked bi-annually with only female fish and the lake affords no spawning habitat, only odd age fish should be observed. The age results provided by NSC indicated that there were age 4 and 6 fish. Although not ruled out, these even ages were unlikely. Therefore, the scale prints were reviewed a second time by Program biologists and a final age was determined for these 15 fish. These final results were based on the knowledge of the lake, stocking history, and lack of suitable spawning habitat in Pothole Lake.

During the reconnaissance survey conducted in 1989, the gill net CPUE effort was very successful. The net fished during the day for only 2.5 hours and captured 22 rainbow trout (CPUE = 8.8 rainbow trout per hour). At that time, it was noticed that the majority of these fish were spawnbound. Although, some clean patches of gravel near the shore were noted and may have been used for shore spawning activity.

Mean lengths and weights were calculated by age for all fish (Table 3). Condition factors were also determined for the entire sample (Table 4). The average conditions between sample years were relatively the same (CF = 1.1) indicating healthy fish.

Table 3. Population characteristics of rainbow trout in Pothole Lake, 2001.

Age Class	Sample No.	Mean Length (cm)	Range of Length (cm)	SD for Length	Mean Weight (g)	Range of Weight (g)	SD for Weight
1	3	12.53	12.0-13.1	0.55	21.7	17.0-25.0	4.16
3	8	39.28	38.0-40.8	1.03	684.5	548.0-812.0	83.49
5	15	42.59	40.0-44.7	1.42	875.4	750.0-1011.0	81.4

Lake: **Pothole (43 Mile) Lake**

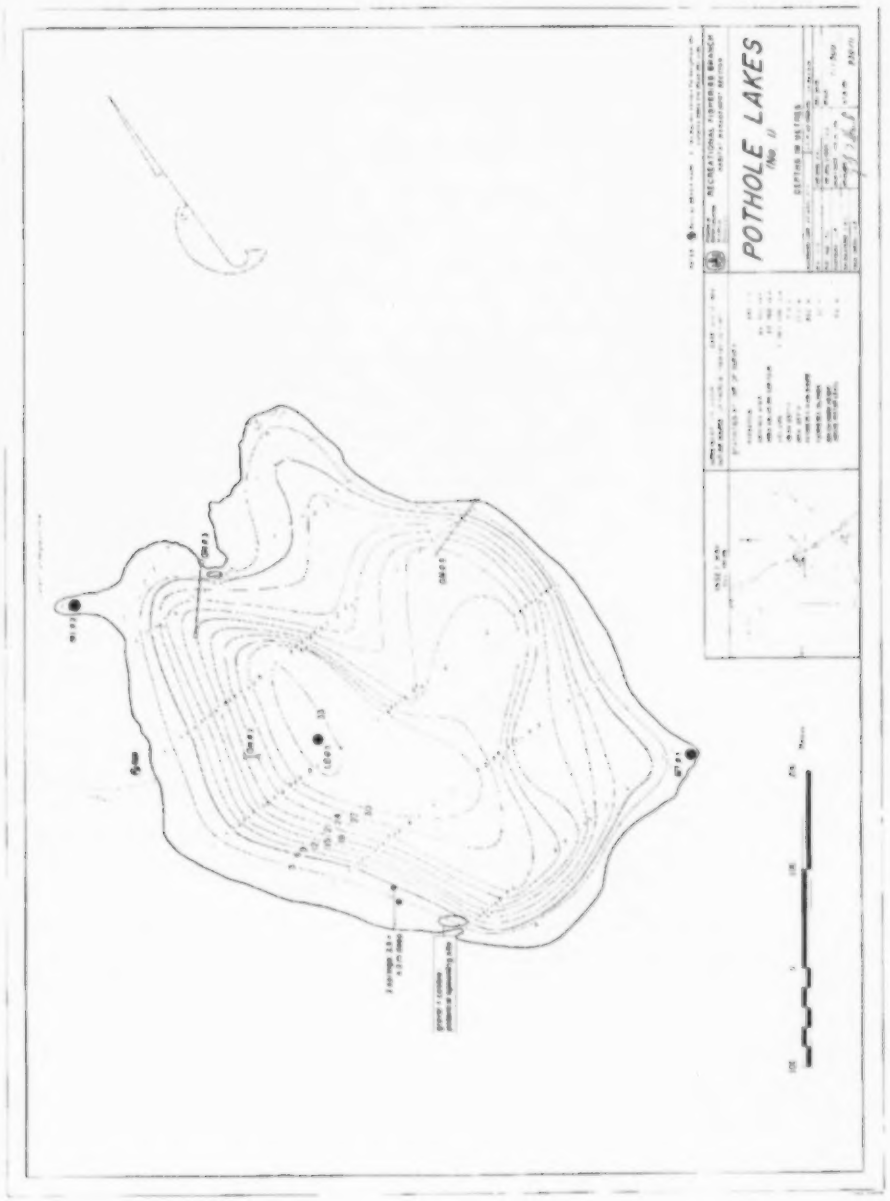

Figure 2. Location of gill net sets, Gee traps, limnology station, and benchmark.

Table 4. Condition factors for rainbow trout captured in Pothole Lake in 1989 and 2001.

Condition Factor	1989 Survey Results	2001 Survey Results
Number of fish	22	26
Mean C.F.	1.11	1.13
Minimum C.F.	0.92	0.97
Maximum C.F.	1.29	1.34
Standard Deviation	0.10	0.10

The overall conditions for the 2001 fish are healthier as compared to the 1989 sampled fish (Figures 3 and 4). In 1989, the condition of these fish were getting slightly smaller (skinny) as they got older. It is unknown why these fish appeared smaller with age but one speculation could be that the food resources were becoming less plentiful or there were some ageing errors. In 2001, the sampled fish expressed better conditions as they matured. This would suggest that the food resources may no longer be in short supply and that there doesn't appear to be too many fish stocked within the lake.

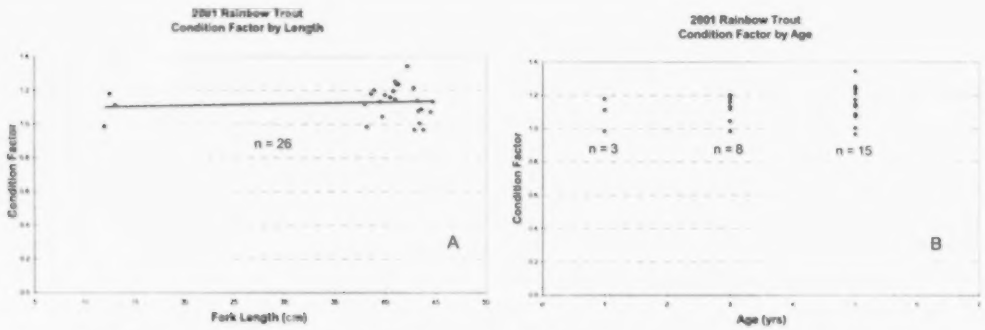

Figure 3. Condition factors of rainbow trout in Pothole Lake, 2001.

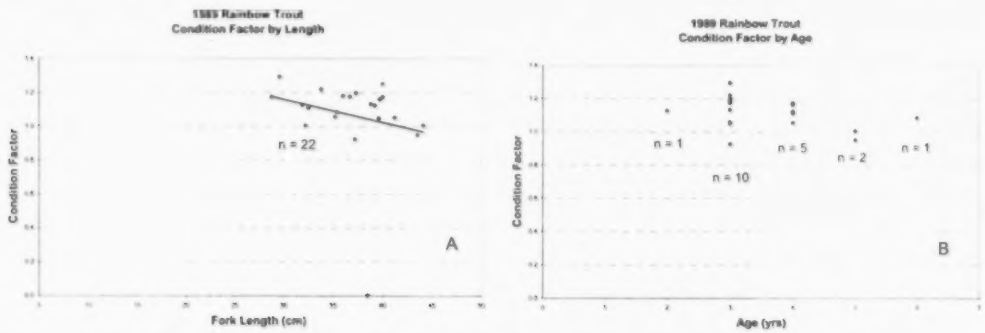

Figure 4. Condition factors of rainbow trout in Pothole Lake, 1989.

The average length at age between years is also quite similar (Figures 5 and 6), although the 1989 assessment was conducted in June and the 2001 assessment in late September. Both years sample of fish are expressing good growth rates, based on the time of year they were captured. The 2001 fish are reaching 40 cm by age 3.

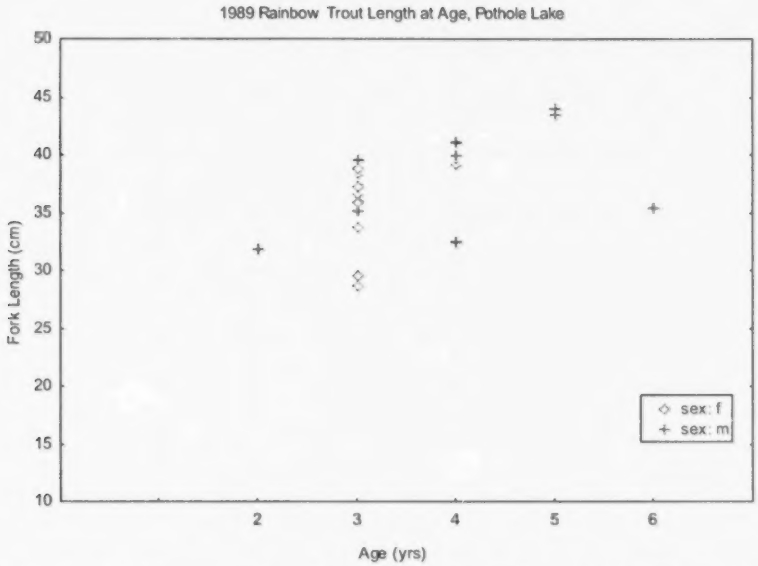

Figure 5. Age versus length of rainbow trout in Pothole Lake, 1989.

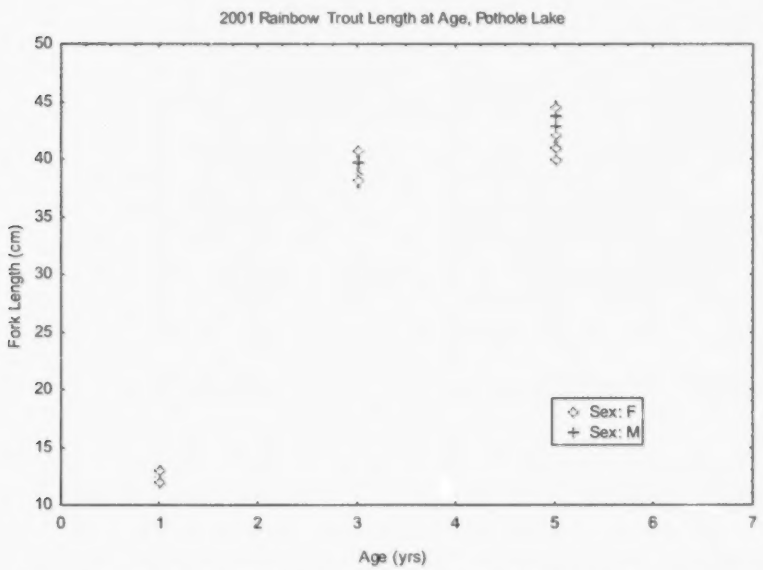

Figure 6. Age versus length of rainbow trout in Pothole Lake, 2001.

The range in lengths for each age appear slightly more scattered in 1989. It is unknown if the ages read in 1989 had any discrepancies. With the Pothole Lake data presenting some discrepancy in ages, a length-frequency graph was created to help validate the final ages (Figure 7). Examination of the 2001 data also proved to be difficult with the length-frequency graph and did not present any distinct age classes with a 2.5 cm bin size.

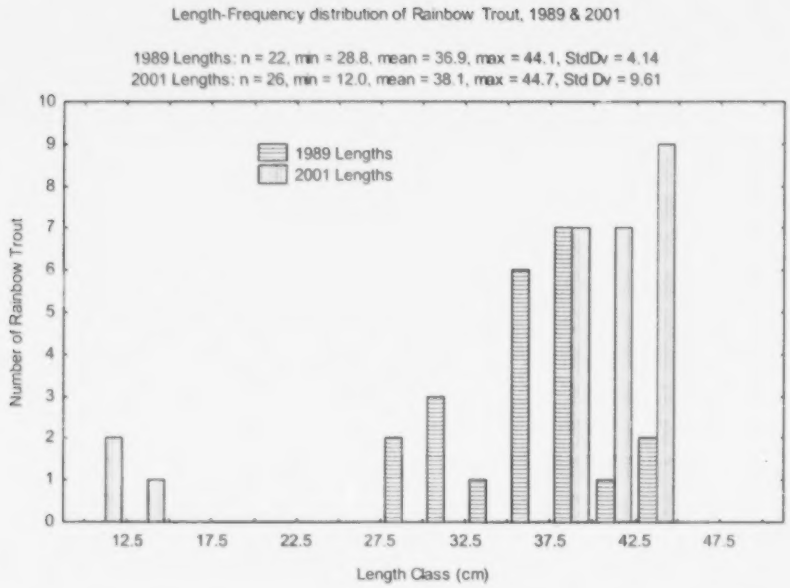

Figure 7. Length-frequency distribution of rainbow trout in 1989 and 2001.

The power function was used to examine the fish's body shape (i.e. weight-length data). This function ($W = aL^b$) provides a general description on how robust a fish is based on body shape (Figures 8 and 9). A "b" value greater than 3.0 represents a fish that becomes more rotund as length increases and less than 3.0 indicates a fish becoming less rotund.

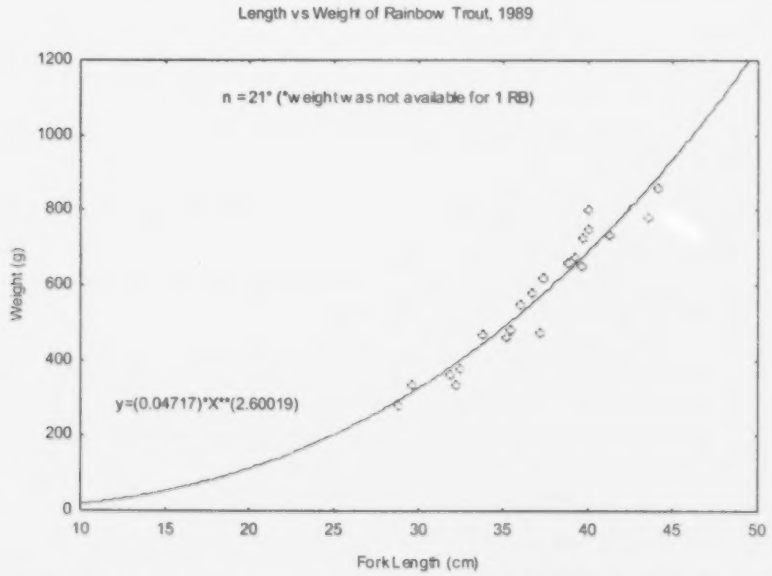

Figure 8. Length versus weight of rainbow trout in Pothole Lake, 1989.

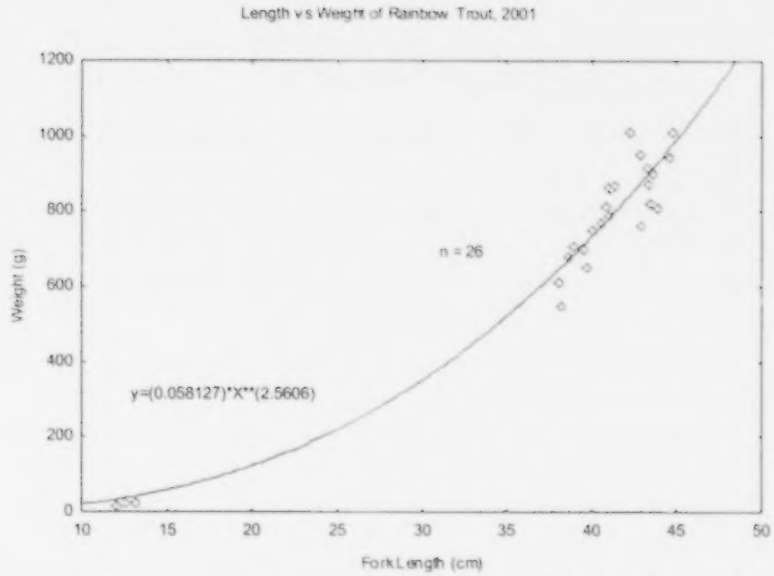

Figure 9. Length versus weight of rainbow trout in Pothole Lake, 2001.

Many larger sized fish (over 35 cm) were observed in 2001 as compared to the 1989 sample. The change in weight as a function of length is described by the equation weight (g) = 0.058127 x Length (mm) $^{2.56}$, suggesting that Pothole Lake fish are becoming lighter for a given length as they grow longer (in 2001). If this were true, this would suggest a constraint on condition as a fish grows. When examining the relative condition/length by age class (Figures 3 and 6), the rainbow trout are expressing good growth and appear to be healthy. The fish in the 10-15 cm range may be biasing the length-weight model developed for 2001.

Gee Traps

Two Gee traps, baited with sardines, were used to capture juvenile fish. The traps were set overnight (Figure 2) for a minimum of 22.3 hours (Table 5). Gee trap #2 produced 29 lake chub and 1 rainbow trout.

Table 5. Gee trap results, Pothole (43 Mile) Lake, 2001.

Trap No.	Hours Fished	Depth (m)	Substrate	Species	Number	Size Range (mm)
1	22.39	0.9 m	aquatic plants, LWD[1]	no fish, dragonfly nymph	1	n/a
2	22.37	1.0 m	aquatic plants, LWD[1]	lake chub	29	48 – 90
2	22.37	1.0 m	aquatic plants, LWD[1]	rainbow trout	1	120

[1]LWD = large woody debris

Angling

On September 24, Program biologists angled for 1.5 hours using two rods. No fish were caught but a few strikes were noticed.

BIOLOGICAL ANALYSIS OF RAINBOW TROUT

A biological analysis was conducted on 26 rainbow trout (Appendix 2). Twenty-three fish caught were females and three fish were males. Reproductive organ analysis revealed four maturity levels: immature (1 year olds), maturing (3 year olds), and mature and spawnbound (3 and 5 year olds). Four females were spawnbound (full of eggs). Of these, three of the females were producing next years eggs.

Examination of the stomach contents suggest that rainbow trout are preying primarily on zooplankton. Other common foods included *Trichoptera* and *Gammarus* species and some winged insects. External examination indicated healthy fish. Internal examination revealed tapeworms in four fish.

DRAINAGE

Pothole Lake is a closed lake system (no inlets or outlet). Examination of the entire perimeter of the lake confirmed the lack of any streams entering or leaving the lake. Although, two springs were noted on the south west shore (Figure 2). These springs were roughly 50 cm in diameter and were in shallow water (4.0 m or less).

BENCHMARK

The original benchmark, located on the west shore, was re-located by Program biologists during the 2001 survey (Figure 2). This benchmark was originally set in 1989, 2.0 m above the lake water level. The 2001 survey revealed that the water level increased 67 cm from the 1989 date. In 2001, the water level was at 1.33 m. This benchmark is located in a 40 cm D.B.H. white spruce tree, 4.8 m from the current water level at the time of this survey.

LIMNOLOGY

A limnology station was established near the central part of the lake (Figure 2). The limnology profile was completed on September 24, 2001 at 1510 hours. A depth sounder was used to determine the deepest part of the lake (34 m). Weather conditions were sunny, calm, and warm with 10% cloud cover. Water temperature and dissolved oxygen measurements were taken at 1.0 m intervals (Table 6). Readings were taken up to 26 m in

depth (maximum cord length). Oxygen levels for rainbow trout were adequate in the first 22 m of the water column.

Table 6. Limnology Profile for Pothole Lake, September 24, 2001.

Depth (m)	Dissolved Oxygen (O_2)	Temperature (degrees Celsius)
Surface	9.3	14.3
1.0	9.2	14.0
2.0	9.4	13.9
3.0	9.4	13.8
4.0	--	--
5.0	9.0	13.8
6.0	--	--
7.0	9.1	13.7
8.0	--	--
9.0	--	--
10.0	9.5	13.4
11.0	11.2	11.4
12.0	11.0	10.4
13.0	10.8	9.4
14.0	10.9	8.8
15.0	10.6	7.9
16.0	9.9	7.4
17.0	--	--
18.0	9.1	6.6
19.0	--	--
20.0	6.9	6.0
21.0	--	--
22.0	5.1	5.6
23.0	--	--
24.0	3.9	5.4
25.0	--	--
26.0	1.8	5.1
27.0	end of cord	end of cord
28.0 to 33.0	readings not taken	readings not taken
34.0	bottom	bottom

FISHERIES MANAGEMENT COMMENTS

Rainbow Trout

Pothole Lake appears to have supported a healthy population of stocked rainbow trout over the past decade. In 1989, gill net #1 (day time set) yielded 4.4 rainbow trout per net-hour. In September 2001, gill net #1 (overnight net set) produced 0.74 rainbow trout per net-hour. Gill net #3 (day time set) produced 1.6 rainbow trout per net-hour. Although these nets were set in roughly the same locations between years, the dates the nets were set are different and the soak times were different. Overall, the size of catchable fish caught in the gill nets were larger (showing good growth) in 2001 than compared to the 1989 catch. Some of the age 3 fish are reaching 40 cm in length. This may have resulted in the

switching of stocks (to all females) in 1995 or that the angling pressure on the lake is currently low.

During the 1989 survey, 95 % of the sampled fish were spawnbound. Only four rainbow trout were observed in this condition in 2001. It is possible that the majority of these females sampled already "dropped their eggs" by the time of this survey (September). By switching stocks (in 1995 to all females), this may have reduced the occurrence of this problem. It is presumed the majority of females are locating a place in the lake to release their eggs. It is suspected that this is happening by the 2 springs or on some exposed gravel shoals on the south west shore (Figure 2). With only a few males present and the lack of any spawning stream, recruitment levels are presumed to be near zero.

Non-game fish

Pothole Lake also supports a population of lake chub. Although not studied intensively, the population was abundant and appear to be healthy. No lake chub were observed in the stomachs of the captured rainbow trout. No new fish species were captured in the small panel (19 mm stretch mesh).

MISCELLANEOUS COMMENTS

1. Photographs of Pothole Lake were taken of some fish species and the surrounding habitat. Most photos were taken to document the change in features over time (i.e. habitat) and are not significant to the relevance of this report on fish stocking. Therefore, these photos are not displayed in this fish stock assessment report but can be viewed at the address indicated at the beginning of this report.

FISH STOCKING PROGRAM

The current rainbow trout stocking program in Pothole Lake appears to be adequate but still requires future investigation to address a few unanswered questions. Understanding the CPUE of anglers would assist with the recommendations to the stocking program. An accurate count of anglers on Pothole Lake is impossible to know with any certainty and a future creel survey may help determine this answer. A winter fishery exists on this lake as well. Future data collection on all of these points will help assist with the stocking recommendations for Pothole Lake.

Another more economical way to determine the CPUE would be to conduct a limited creel survey during high use periods (i.e. long weekends). This survey may be a more cost effective means to obtain CPUE data without having to conduct a full creel survey. Future data collection and anecdotal information received will provide a better idea of the angler use/CPUE and would assist with the future stocking recommendations for Pothole Lake.

From the fish captured in the 2001 survey, there appears to be no evidence of stunting. The condition factor for the 2001 fish was 1.13 (n = 26). These results indicate healthy fish and there appears to be no problem with overpopulation. Three year old fish are reaching lengths as much as 40 cm. Although, it was felt that the gill net and angling CPUE could increase slightly. The gill net CPUE in 1989 was higher than in 2001 and the angling results in 2001 were marginal. Pothole Lake appears that it can support an additional amount of fish stocked each cycle. Therefore, it is recommended to increase the stocking rate by 500 fish (from 1,500 to 2,000). The intent here is to ultimately increase angler CPUE. This stocking number may have to be re-defined in the future once a better understanding of the angler use on Pothole Lake is determined.

The next scheduled assessment for Pothole Lake is recommended to take place in the summer of 2006. By that time, two complete stockings of the increased number of fish will have taken place. In addition, the assessment will coincide with a non stocked year so newly stocked hatchery fish are not captured unnecessarily.

OTHER RECOMMENDATIONS

Understanding the CPUE would assist with future recommendations to the stocking program. While local anglers are targeting Pothole Lake, it is unknown as to the amount of angling use on this lake. The 1989 assessment report suggested that Pothole Lake does not receive much summer use but does receive moderate pressure during the winter as an ice fishery. An accurate count of anglers on Pothole Lake is impossible to know with any certainty although a future creel survey will help answer some of these questions. While on the ground creels can be expensive, another possible solution could be to undertake an aerial boat count survey. This survey was developed by the MWLAP under the Small Lakes Index Management (SLIM) program. This program can be a good indicator of angler use and Pothole Lake would be suitable for this type of angler use survey.

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Lake: **Pothole (43 Mile) Lake**

APPENDIX 1

Netting Record

Lake: **Pothole (43 Mile) Lake**

NETTING RECORD **September 24 to 25, 2001**

NETTING SITE #1 Mesh sizes experimental order: 25, 76, 51, 89, 38, 64 mm

Type:	Sinking monofilament gill net		
Date Set:	September 24, 2001	Time:	1445hrs
Date Lifted:	September 25, 2001	Time:	1510 hrs
Net Dimensions:	Length: 91.4 m	Depth:	2.4 m
Shallow End Mesh Size:	25 mm	Depth: Substrate:	0.8 m aquatic plants/SWD
Deep End Mesh Size:	64 mm	Depth: Substrate:	17.0 m unknown

Comments:

Net was set overnight. Net was pulled at 0930 hrs on September 25; produced 17 lake chub and 18 rainbow trout. Net was reset and pulled again at 1510; no fish caught this time (1 RB escaped as net was pulled). Gill net #1 produced 18 RB.

NETTING SITE #2 Mesh sizes (1 panel): 19 mm

Type:	Sinking monofilament gill net		
Date Set:	September 24, 2001	Time:	1055 hrs
Date Lifted:	September 25, 2001	Time:	1145 hrs
Net Dimensions:	Length: 15.24 m	Depth:	2.4 m
Shallow End Mesh Size:	19 mm	Depth: Substrate:	21 to 24 m unknown
Deep End Mesh Size:	19 mm	Depth: Substrate:	21 to 24 m unknown

Comments:

Net was set overnight and pulled the next morning. No fish were caught.

Lake: **Pothole (43 Mile) Lake**

NETTING RECORD **September 25, 2001**

NETTING SITE # 3 Mesh sizes experimental order: 25, 76, 51, 89, 38, 64 mm

Type:	Sinking monofilament gill net		
Date Set:	September 25, 2001	Time:	1000 hrs
Date Lifted:	September 25, 2001	Time:	1430 hrs
Net Dimensions:	Length: 91.4 m	Depth:	2.4 m
Shallow End Mesh Size:	25 mm	Depth:	0.7 m
		Substrate:	organics/ aquatic plants
Deep End Mesh Size:	64 mm	Depth:	14.0 m
		Substrate:	unknown

Comments:

Net was set during the day and was left to fish for 4.5 hours. Net was pulled at 1430. Gill net #3 produced 7 RB.

APPENDIX 2

Individual Fish Data

Lake: **Pothole (43 Mile) Lake**

INDIVIDUAL FISH DATA

Date Captured: September 25, 2001
Gill Net # 1

M - Male, F - Female, ? - Not Obvious
IMM - Immature, MG - Maturing, MT - Mature, GV - Gravid, SP - Spent, ? - Not Obvious
EG - Egg, ML - Milt, HD - Head, TG - Fish Tag, ST - Stomach
SC - Scale, FR - Fin Ray, OT - Otolith, WF - Whole Fish

Method of Capture: Sinking monofilament gill net.
Condition Factor (K) = $W / L^3 \times 100$

Species	Fork Length (cm)	Weight (grams)	Condition Factor	Gonadal Maturity	Sex	Sample Type	Age (yrs)	Stomach Contents				Comments
								Plankton	Insects	Fish	Other	
RB	38.9	706.0	1.20	MG	F	SC	3	zooplankton	worms			not spawnbound
RB	43.6	901.0	1.09	MG	F	SC	5	zooplankton				not spawnbound; empty
RB	43.2	917.0	1.14	MG	F	SC	5		lots green worms			not spawnbound; full
RB	39.5	697.0	1.13	MG	F	SC	3	zooplankton				empty
RB	44.7	1011	1.13	MG	F	SC	5	zooplankton	green worms		detritus	full
RB	43.4	820.0	1.00	MG	F	SC	5	zooplankton	worms	shrimp		tapeworms
RB	43.3	874.0	1.08	MG	F	SC	5	zooplankton green		shrimp		
RB	41.1	859.0	1.24	MG	F	SC	5	zooplankton green				full
RB	42.2	1009	1.34	Full of eggs	F	SC	5	zooplankton		clam		spawnbound with next yrs. Eggs
RB	40.5	769.0	1.16	MG	F	SC	3	zooplankton				too digested
RB	38.0	613.0	1.12	Full of eggs	F	SC	3	zooplankton	green worms	shrimp		spawnbound, no 2nd eggs
RB	12.5	23.0	1.18	IMM	F	SC	1					unknown
RB	13.1	25.0	1.11	IMM	F	SC	1	zooplankton	winged insect			
RB	41.0	863.0	1.25	MG	F	SC	5	zooplankton				tapeworms
RB	38.6	678.0	1.18	MG	F	SC	3	zooplankton green				tapeworms; full
RB	43.8	811.0	0.97	Red	M	SC	5		green worms			looks spawnbound
RB	42.9	762.0	0.97	MG	M	SC	5	zooplankton	worms			small testes; looks red; empty
RB	39.7	653.0	1.04	MG	M	SC	3	zooplankton		clams	detritus	

Ch.	chaoborus	P.M.	phantom midge	T.W.	tapeworms	Da.	daphnia
Cl.	clams	O.M.	organic matter	S.	snails	Di.	diptera
G.	gammarus	L.	lice	M.	mayflies (general)	Ca.	callibaetis
Le.	leeches						

Lake: **Pothole (43 Mile) Lake**

INDIVIDUAL FISH DATA

Date Captured: September 25, 2001
Gee trap # 2 + Gill Net # 3

M - Male
F - Female
? - Not Obvious

IMM - Immature
MG - Maturing
MT - Mature
GV - Gravid
SP - Spent
? - Not Obvious

EG - Egg
ML - Milt
HD - Head
TG - Fish Tag
ST - Stomach

SC - Scale
FR - Fin Ray
OT - Otolith
WF - Whole Fish

Method of Capture: Sinking monofilament gill net.
Condition Factor (K) = $W / L^3 \times 100$

Species	Fork Length (cm)	Weight (grams)	Condition Factor	Gonadal Maturity	Sex	Sample Type	Age (yrs)	Stomach Contents				Comments
								Plankton	Insects	Fish	Other	
RB	12.0	17.0	0.98	IMM	F	SC	**1**					Gee trap # 2; empty
RB	41.3	870	1.24	MG	F	SC	**5**	zooplankton	insects			
RB	40.8	812	1.20	MG	F	SC	**3**	zooplankton	green worms	shrimp		full stomach; tapeworms
RB	44.5	944	1.07	MG	F	SC	**5**	zooplankton	green worms	shrimp		full stomach
RB	42.8	951	1.21	Full of eggs	F	SC	**5**	zooplankton	green worms	shrimp		spawnbound with 2nd set of eggs
RB	41.0	789	1.14	MG	F	SC	**5**		green worms		detritus	
RB	40.0	750	1.17	MG	F	SC	**5**	zooplankton	winged insect		detritus	
RB	38.2	548	0.98	SP	F	SC	**3**	zooplankton		shrimp		24 eggs left over; 2nd set eggs developing; alternate yr spawner

Ch.	chaoborus	P.M.	phantom midge	T.W.	tapeworms	Da.	daphnia
Cl.	clams	O.M.	organic matter	S.	snails	Di.	diptera
G.	gammarus	L.	lice	M.	mayflies (general)	Ca.	callibaetis
Le.	leeches						

Lake: **Pothole (43 Mile) Lake**

AGE DETERMINATION

COMPLETED BY:

North/South Consultants
83 Scurfield Blvd.
Don Macdonel and Paul Graveline
Winnipeg, Manitoba, R3T 1G4

and

Arne Langston
Peace/Williston Fish and Wildlife Compensation Program
1011, 4th Ave.
Prince George, BC V2L 3H9

PEACE/WILLISTON
FISH & WILDLIFE
COMPENSATION
PROGRAM

BC hydro

BRITISH
COLUMBIA

Fish Stocking Assessment of Pothole (43 Mile) Lake, 2001

R. J. Zemlak and D. M. Cowie

January 2004

PWFWCP Report No. 284

The Peace/Williston Fish & Wildlife Compensation Program is a cooperative venture of BC Hydro and the provincial fish and wildlife management agencies, supported by funding from BC Hydro. The Program was established to enhance and protect fish and wildlife resources affected by the construction of the W.A.C. Bennett and Peace Canyon dams on the Peace River, and the subsequent creation of the Williston and Dinosaur Reservoirs.

Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave. 3rd Floor, Prince George B.C. V2L 3H9

Website: *www.bchydro.com/pwcp/*

This report has been approved by the Peace/Williston Fish and Wildlife Compensation Program Fish Technical Committee.

Citation: Zemlak, R.J. and D.M. Cowie. 2004. Fish stocking assessment of Pothole (43 Mile) Lake, 2001. Peace/Williston Fish and Wildlife Compensation Program Report No. 284. 14pp plus appendices.

Author(s): Randy J. Zemlak[1] and Dawn M. Cowie[1]

Address(es): [1] Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave., 3rd Floor, Prince George, B.C. V2L 3H9

Pothole (43 Mile) Lake

WATERSHED:	Parsnip River
DATE OF SURVEY:	September 24 and 25, 2001
FIELD CREW LEADER:	Randy J. Zemlak
FIELD ASSISSTANT:	Arne R. Langston

PEACE/WILLISTON FISH AND WILDLIFE COMPENSATION PROGRAM

B.C. HYDRO

GENERATION

and

MINISTRY OF WATER, LAND and AIR PROTECTION

ENVIRONMENTAL STEWARDSHIP DIVISION

REPORT PREPARED BY: RANDY J. ZEMLAK
DAWN M. COWIE

Lake: **Pothole (43 Mile) Lake**

INTRODUCTION

Pothole (43 Mile) Lake, located near Mackenzie BC (Figure 1), is a small kettle lake off of the Six Mile Bay Recreation Road. This lake has been researched for a number of years. A brief lake inventory was conducted in 1979 (Anonymous 1979). Very little information was collected on the lake habitat and species present at that time. During the next year, the lake was deemed suitable for fish introductions. After 6 stocking cycles, a more formal standard fisheries baseline reconnaissance level survey of Pothole Lake was conducted by the Peace/Williston Fish and Wildlife Compensation Program (PWFWCP). The status of the current fish population and recommendations for future enhancements were provided to BC Environment (Jesson 1989). All of the above reports can be viewed at the PWFWCP office.

During September 2001, PWFWCP fish biologists re-investigated Pothole Lake primarily to evaluate the success of the current fish stocking program and to determine if changes to the stocking program were required.

LAKE LOCATION

Location:	38.9 km north/northeast of Mackenzie BC
Elevation:	± 693 m
Latitude/Longitude:	55° 35' 44" : 123° 22' 40"
U.T.M.:	10.0476193.6161132 (NAD 1983)
Management Unit:	7-30
N.T.S. Map No.:	93 - O/11
Watershed:	Parsnip River
Waterbody Identifier:	00357PARA
Lake Drainage:	closed system

ACCESS

Although access to Pothole Lake has not changed significantly since the original reconnaissance level lake inventory (1989), exact road directions and conditions may have changed over time. From the Alexander Mackenzie Hotel in Mackenzie (0.0 km), drive north on the Mackenzie Boulevard/Finlay Forks Forest Service Road. At 0.4 km, drive straight through the 4 way intersection. At 7.5 km, the road changes from a two lane paved road to a two lane gravel (2wd) road. At 9.5 km, there is a four way intersection. Stay straight on the Parsnip West Forest Service Road. At 10.4 km, stay right at this three way intersection. At 19.7 km, go straight (do not go right on the Tony Creek main line road). At 41.1 km turn left onto the Six Mile Bay recreation Site Road. Continue straight for 0.4 km and turn left onto an unnamed road. Drive 0.5 km to the access trail head location and parking area (UTM 10.0475816.6160865). From the parking area, walk down the steep access trail approximately 170 m to the lake.

Lake: **Pothole (43 Mile) Lake**

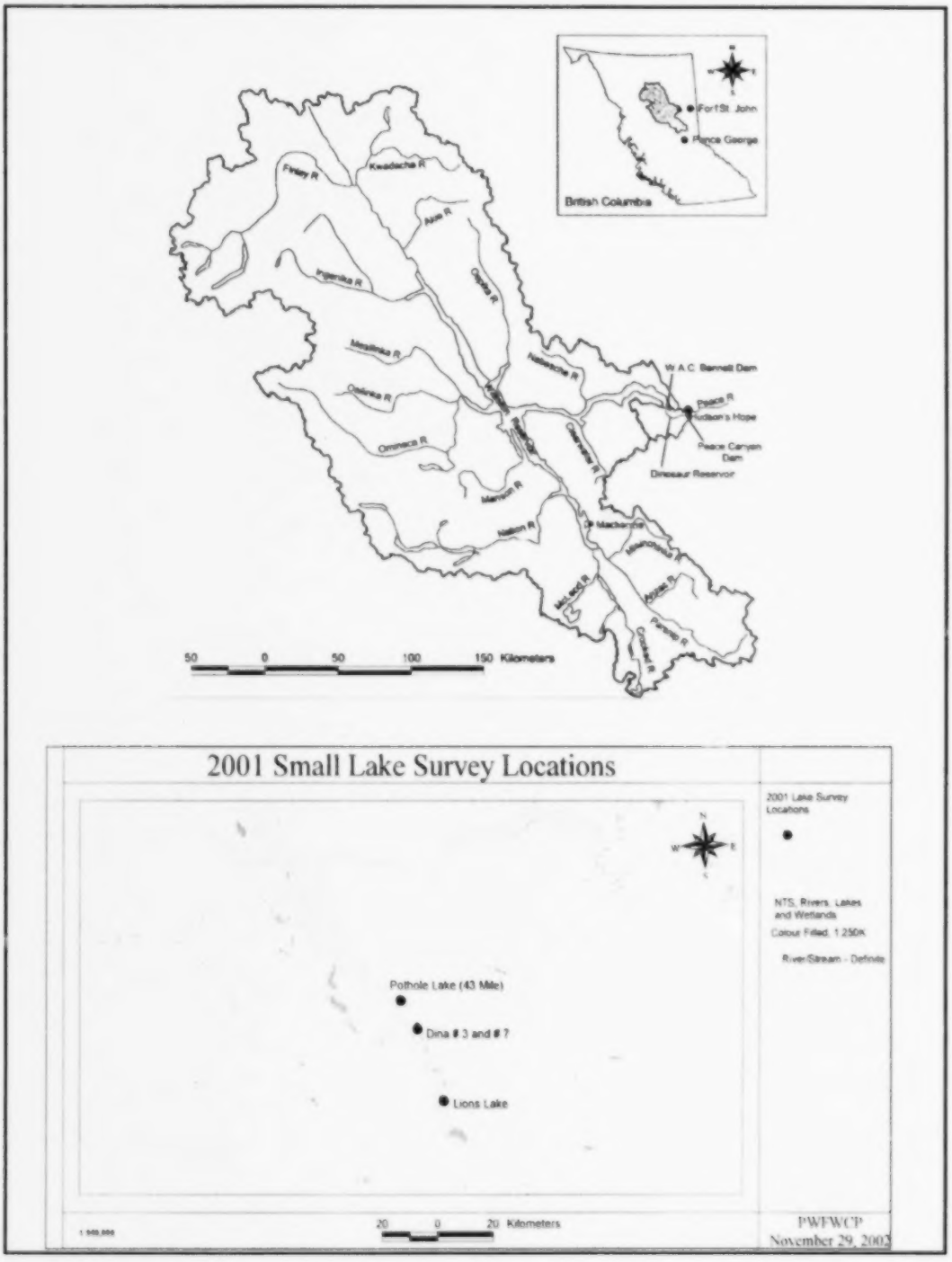

Figure 1. Location of Pothole (43 Mile) Lake.

STOCKING HISTORY

Rainbow Trout

Pothole Lake was initially stocked with 10,000 rainbow trout in 1980 (Table 1). Stocking numbers were initially high (to get the lake started), and have now decrease over time. Currently, the lake is being stocked bi-annually with 1,500 yearlings (since 1995).

Table 1. Pothole Lake rainbow trout stocking history.

Year	Number	Size (g)	Life Stage	Stock
1980	10,000	6.3	UN	Badger
1981	5,000	5.7	UN	NRT Premier
1982	5,000	4.0	UN	NRT Premier
1983	5,000	4.0	UN	NRT Premier
1985	2,500	0.8	UN	NRT Premier
1987	2,500	12.8	UN	NRT Premier
1989	2,500	10.4	YE	Tunkwa
1990	2,500	16.6	YE	Tunkwa
1991	2,500	5.1	YE	Badger
1993	2,500	2.9	YE	NRT Premier
1995	1,500	18.5	YE	Pennask AF
1997	1,500	17.1	YE	Pennask Hath AF
1999	1,500	15.2	YE	Pennask Beav AF
2001	1,500	12.7	YE	Pennask BV AF

Originally, natural rainbow trout were stocked. Between 1993 and 1995, the stock of fish was changed to all female fish. The reason for this change was that the single female fish had a higher survival rate when put in a system like Pothole (i.e. no available spawning). Therefore, less fish would be required to stock the lake and the extra fish could be put towards another system in the area.

METHODS

Three different techniques were used to determine relative abundance of fish species in Pothole Lake. Conversations with Ministry of Water, Land and Air Protection (MWLAP) fish biologists prior to the gill netting effort suggested that it would be valuable to have at least 10 fish sampled from each age group to accurately provide future recommendations to the stocking program. Therefore, it may have been deemed necessary to keep the nets in the water overnight. Two sinking monofilament experimental gill nets were set to capture fish. Net one consisted of six different sized mesh panels ranging from 25 to 85 mm. Each panel is 15.24 m long and 2.4 m wide. This net was set twice, with the first set remaining over night and the second during the day. The second net was a single panel gill net, 19 mm stretch mesh, 15.24 m long and 2.4 m wide and was set overnight.

The second method used was Gee traps. Each Gee trap (two in total) was baited with sardines and set overnight. The Gee traps were set in shallow (< 2 m) littoral habitat. The third technique used to capture fish was angling gear. A spin cast rod with an assortment of lures and a fly rod with dry flies were utilised. Angling efforts by Program biologists were recorded to determine catch per unit effort (CPUE).

Captured rainbow trout were measured for fork length (mm) and weight (g). A biological examination of the fish was conducted which revealed it's sex, maturity, stomach contents, and disease/parasite presence. Scale samples were collected for age determination and analysis was performed by North/South Consultants (NSC). General appearance of the fish was recorded through visual analysis. Photos of fish were taken. Mean lengths and weights were determined for each age class of rainbow trout. Condition factors ($Weight(g)/Length(cm)^3 \times 100$) were determined for each individual fish and each age class.

Non-game species were also enumerated and sampled for fork length and weight. General appearance of these fish was observed and recorded. Any non-game fish captured that were still alive in the gill nets were released immediately.

The habitat features of Pothole Lake were briefly assessed. The entire perimeter of the lake was observed to confirm the lack of any inlets or an outlet stream. The benchmark set during the original study (1989) was located. Changes to the current lake level was measured with an Abney level, 1.5 m staff, and a 30 m Eslon tape. Any new campsites and other developments identified after the original survey in 1989 were also recorded. Photo documentation was taken of the lake habitat but is not presented in this report.

A limnology station was established to profile the water temperature and dissolved oxygen at varying depths. A YSI model 58 O_2/Temp. meter was used for the limnological profile.

RESULTS

Of the three methods used to capture fish in Pothole Lake, gill nets and Gee Traps were the methods that produced fish (Table 2). No fish were captured by angling.

Table 2. Lake catch summary for Pothole Lake, 2001.

Date	Species	Net Set Number			Gee Traps		Angled	Total Sampled	Size Range
		1	2	3	1	2			(cm)
Sept. 24	none						0	0	-
Sept. 25	RB	X						18	12.5 – 44.7
Sept. 25	LKC	X						17	10.5 – 12.0
Sept. 25	none		X					0	-
Sept. 25	RB			X				7	54.8 – 44.5
Sept. 25	none				X			0	-
Sept. 25	RB					X		1	12.0
Sept. 25	LKC					X		29	4.8 – 9.0

Gill Nets

Three gill net sets were conducted on September 24 and 25 (Figure 2), with sets #1 and #2 remaining overnight. Set #1 (six panel net) was set for a total of 24.25 hours and produced 18 rainbow trout (CPUE = 0.74 trout / hour) and 17 lake chub. Set #2 (one panel net) was set for 17.6 hours and produced 0 fish. Set #3 (six panel net) was set for 4.5 hours throughout the day and yielded 7 rainbow trout (CPUE = 1.5 trout / hour). The nets were checked periodically throughout the day to avoid capturing too many fish.

All 26 rainbow trout were sampled for stomach content, measured for length and weight, and scale samples taken for age analysis (Appendix 1). From the field observations, there appears to be three maturity levels present: immature (1 year olds), maturing (3 year olds), and spawnbound (3-5 year olds). Of the 26 fish captured, 3 were mature females with ripe eggs, 1 red male (presumed spent), 1 spent female, 18 were maturing, and 3 were immature. Most of the rainbow trout captured were age class 5 fish (15 of 26).

Ageing of fish in Pothole Lake proved to be inconsistent among readers. Age determination for all of the rainbow trout was determined by NSC (Appendix 2). Prints of the scales and age markings were provided for each fish, and reviewed by Program biologists. Many scales were lacking an annulus and could ultimately underestimate the final ages. This problem has also been noted by Lentsch and Griffith (1987). It was then determined that 15 of the ages were deemed incorrect from the NSC analyses. Since the lake has been stocked bi-annually with only female fish and the lake affords no spawning habitat, only odd age fish should be observed. The age results provided by NSC indicated that there were age 4 and 6 fish. Although not ruled out, these even ages were unlikely. Therefore, the scale prints were reviewed a second time by Program biologists and a final age was determined for these 15 fish. These final results were based on the knowledge of the lake, stocking history, and lack of suitable spawning habitat in Pothole Lake.

During the reconnaissance survey conducted in 1989, the gill net CPUE effort was very successful. The net fished during the day for only 2.5 hours and captured 22 rainbow trout (CPUE = 8.8 rainbow trout per hour). At that time, it was noticed that the majority of these fish were spawnbound. Although, some clean patches of gravel near the shore were noted and may have been used for shore spawning activity.

Mean lengths and weights were calculated by age for all fish (Table 3). Condition factors were also determined for the entire sample (Table 4). The average conditions between sample years were relatively the same (CF = 1.1) indicating healthy fish.

Table 3. Population characteristics of rainbow trout in Pothole Lake, 2001.

Age Class	Sample No.	Mean Length (cm)	Range of Length (cm)	SD for Length	Mean Weight (g)	Range of Weight (g)	SD for Weight
1	3	12.53	12.0-13.1	0.55	21.7	17.0-25.0	4.16
3	8	39.28	38.0-40.8	1.03	684.5	548.0-812.0	83.49
5	15	42.59	40.0-44.7	1.42	875.4	750.0-1011.0	81.4

Lake **Pothole (43 Mile) Lake**

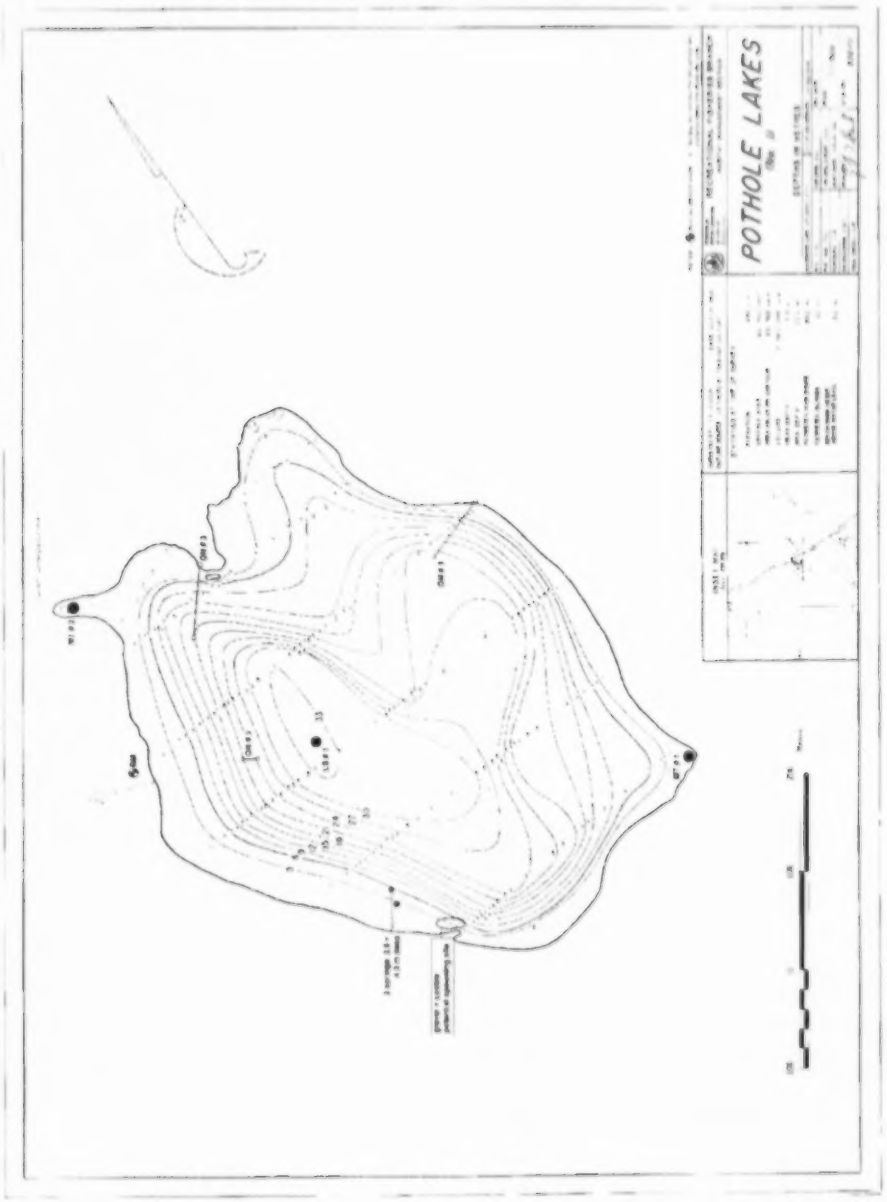

Figure 2. Location of gill net sets, Gee traps, limnology station, and benchmark.

Table 4. Condition factors for rainbow trout captured in Pothole Lake in 1989 and 2001.

Condition Factor	1989 Survey Results	2001 Survey Results
Number of fish	22	26
Mean C.F.	1.11	1.13
Minimum C.F.	0.92	0.97
Maximum C.F.	1.29	1.34
Standard Deviation	0.10	0.10

The overall conditions for the 2001 fish are healthier as compared to the 1989 sampled fish (Figures 3 and 4). In 1989, the condition of these fish were getting slightly smaller (skinny) as they got older. It is unknown why these fish appeared smaller with age but one speculation could be that the food resources were becoming less plentiful or there were some ageing errors. In 2001, the sampled fish expressed better conditions as they matured. This would suggest that the food resources may no longer be in short supply and that there doesn't appear to be too many fish stocked within the lake.

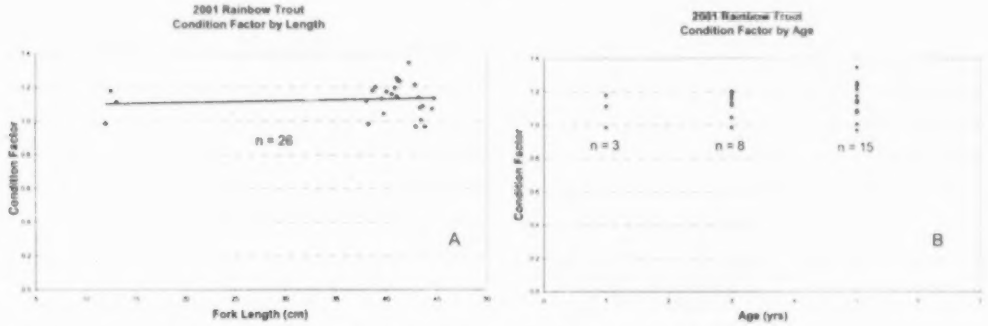

Figure 3. Condition factors of rainbow trout in Pothole Lake, 2001.

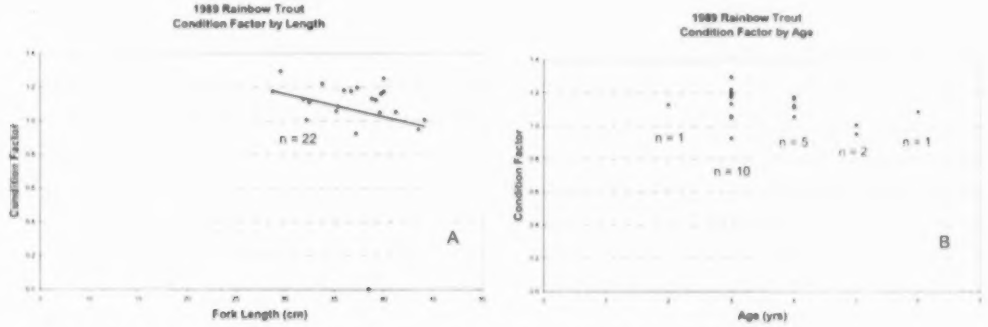

Figure 4. Condition factors of rainbow trout in Pothole Lake, 1989.

The average length at age between years is also quite similar (Figures 5 and 6), although the 1989 assessment was conducted in June and the 2001 assessment in late September. Both years sample of fish are expressing good growth rates, based on the time of year they were captured. The 2001 fish are reaching 40 cm by age 3.

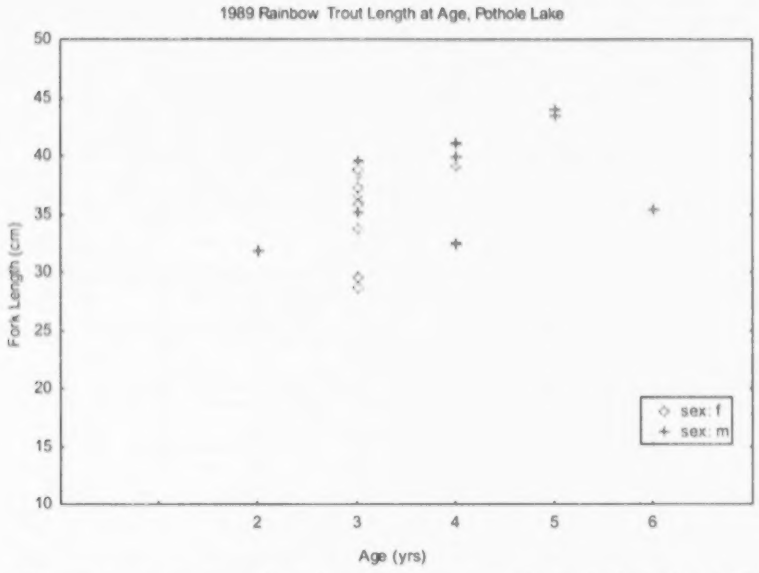

Figure 5. Age versus length of rainbow trout in Pothole Lake, 1989.

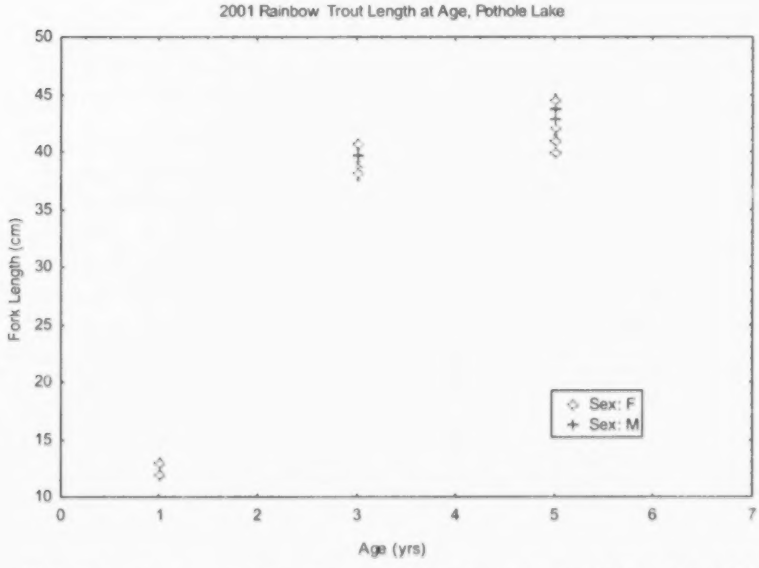

Figure 6. Age versus length of rainbow trout in Pothole Lake, 2001.

The range in lengths for each age appear slightly more scattered in 1989. It is unknown if the ages read in 1989 had any discrepancies. With the Pothole Lake data presenting some discrepancy in ages, a length-frequency graph was created to help validate the final ages (Figure 7). Examination of the 2001 data also proved to be difficult with the length-frequency graph and did not present any distinct age classes with a 2.5 cm bin size.

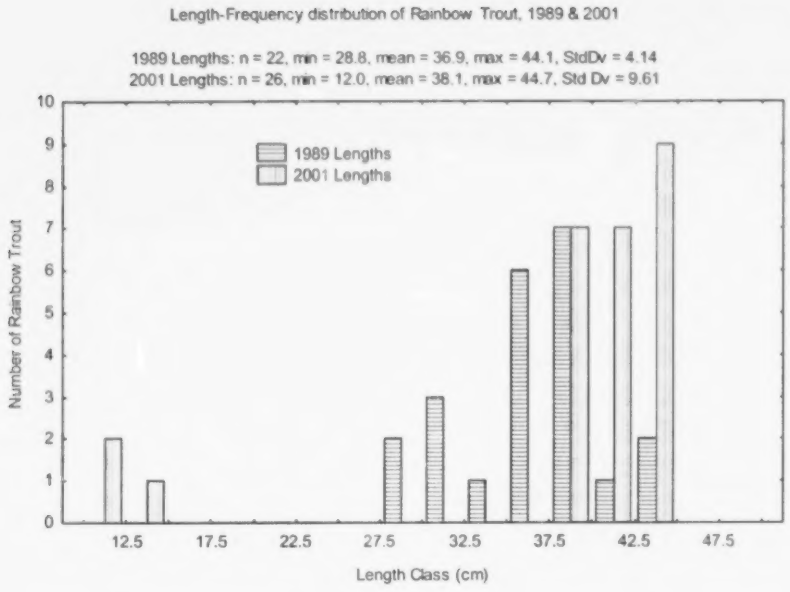

Figure 7. Length-frequency distribution of rainbow trout in 1989 and 2001.

The power function was used to examine the fish's body shape (i.e. weight-length data). This function ($W = aL^b$) provides a general description on how robust a fish is based on body shape (Figures 8 and 9). A "b" value greater than 3.0 represents a fish that becomes more rotund as length increases and less than 3.0 indicates a fish becoming less rotund.

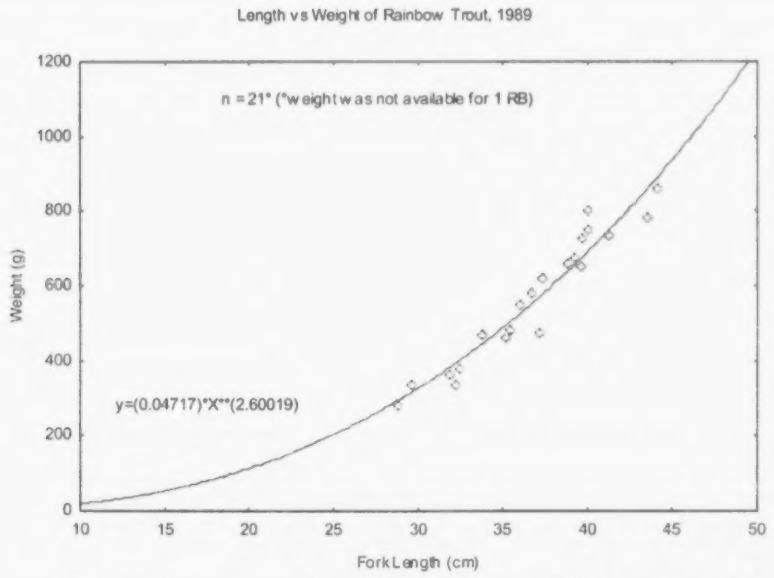

Figure 8. Length versus weight of rainbow trout in Pothole Lake, 1989.

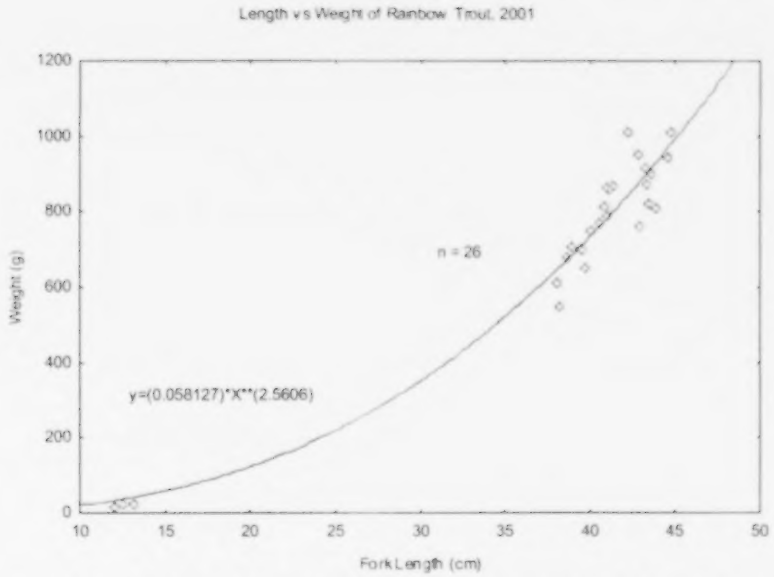

Figure 9. Length versus weight of rainbow trout in Pothole Lake, 2001.

Many larger sized fish (over 35 cm) were observed in 2001 as compared to the 1989 sample. The change in weight as a function of length is described by the equation weight (g) = 0.058127 x Length (mm) $^{2.56}$, suggesting that Pothole Lake fish are becoming lighter for a given length as they grow longer (in 2001). If this were true, this would suggest a constraint on condition as a fish grows. When examining the relative condition/length by age class (Figures 3 and 6), the rainbow trout are expressing good growth and appear to be healthy. The fish in the 10-15 cm range may be biasing the length-weight model developed for 2001.

Gee Traps

Two Gee traps, baited with sardines, were used to capture juvenile fish. The traps were set overnight (Figure 2) for a minimum of 22.3 hours (Table 5). Gee trap #2 produced 29 lake chub and 1 rainbow trout.

Table 5. Gee trap results, Pothole (43 Mile) Lake, 2001.

Trap No.	Hours Fished	Depth (m)	Substrate	Species	Number	Size Range (mm)
1	22.39	0.9 m	aquatic plants, LWD[1]	no fish, dragonfly nymph	1	n/a
2	22.37	1.0 m	aquatic plants, LWD[1]	lake chub	29	48 - 90
2	22.37	1.0 m	aquatic plants, LWD[1]	rainbow trout	1	120

[1]LWD = large woody debris

Angling

On September 24, Program biologists angled for 1.5 hours using two rods. No fish were caught but a few strikes were noticed.

BIOLOGICAL ANALYSIS OF RAINBOW TROUT

A biological analysis was conducted on 26 rainbow trout (Appendix 2). Twenty-three fish caught were females and three fish were males. Reproductive organ analysis revealed four maturity levels: immature (1 year olds), maturing (3 year olds), and mature and spawnbound (3 and 5 year olds). Four females were spawnbound (full of eggs). Of these, three of the females were producing next years eggs.

Examination of the stomach contents suggest that rainbow trout are preying primarily on zooplankton. Other common foods included *Trichoptera* and *Gammarus* species and some winged insects. External examination indicated healthy fish. Internal examination revealed tapeworms in four fish.

DRAINAGE

Pothole Lake is a closed lake system (no inlets or outlet). Examination of the entire perimeter of the lake confirmed the lack of any streams entering or leaving the lake. Although, two springs were noted on the south west shore (Figure 2). These springs were roughly 50 cm in diameter and were in shallow water (4.0 m or less).

BENCHMARK

The original benchmark, located on the west shore, was re-located by Program biologists during the 2001 survey (Figure 2). This benchmark was originally set in 1989, 2.0 m above the lake water level. The 2001 survey revealed that the water level increased 67 cm from the 1989 date. In 2001, the water level was at 1.33 m. This benchmark is located in a 40 cm D.B.H. white spruce tree, 4.8 m from the current water level at the time of this survey.

LIMNOLOGY

A limnology station was established near the central part of the lake (Figure 2). The limnology profile was completed on September 24, 2001 at 1510 hours. A depth sounder was used to determine the deepest part of the lake (34 m). Weather conditions were sunny, calm, and warm with 10% cloud cover. Water temperature and dissolved oxygen measurements were taken at 1.0 m intervals (Table 6). Readings were taken up to 26 m in

depth (maximum cord length). Oxygen levels for rainbow trout were adequate in the first 22 m of the water column.

Table 6. Limnology Profile for Pothole Lake, September 24, 2001.

Depth (m)	Dissolved Oxygen (O_2)	Temperature (degrees Celsius)
Surface	9.3	14.3
1.0	9.2	14.0
2.0	9.4	13.9
3.0	9.4	13.8
4.0	--	--
5.0	9.0	13.8
6.0	--	--
7.0	9.1	13.7
8.0	--	--
9.0	--	--
10.0	9.5	13.4
11.0	11.2	11.4
12.0	11.0	10.4
13.0	10.8	9.4
14.0	10.9	8.8
15.0	10.6	7.9
16.0	9.9	7.4
17.0	--	--
18.0	9.1	6.6
19.0	--	--
20.0	6.9	6.0
21.0	--	--
22.0	5.1	5.6
23.0	--	--
24.0	3.9	5.4
25.0	--	--
26.0	1.8	5.1
27.0	end of cord	end of cord
28.0 to 33.0	readings not taken	readings not taken
34.0	bottom	bottom

FISHERIES MANAGEMENT COMMENTS

Rainbow Trout

Pothole Lake appears to have supported a healthy population of stocked rainbow trout over the past decade. In 1989, gill net #1 (day time set) yielded 4.4 rainbow trout per net-hour. In September 2001, gill net #1 (overnight net set) produced 0.74 rainbow trout per net-hour. Gill net #3 (day time set) produced 1.6 rainbow trout per net-hour. Although these nets were set in roughly the same locations between years, the dates the nets were set are different and the soak times were different. Overall, the size of catchable fish caught in the gill nets were larger (showing good growth) in 2001 than compared to the 1989 catch. Some of the age 3 fish are reaching 40 cm in length. This may have resulted in the

switching of stocks (to all females) in 1995 or that the angling pressure on the lake is currently low.

During the 1989 survey, 95 % of the sampled fish were spawnbound. Only four rainbow trout were observed in this condition in 2001. It is possible that the majority of these females sampled already "dropped their eggs" by the time of this survey (September). By switching stocks (in 1995 to all females), this may have reduced the occurrence of this problem. It is presumed the majority of females are locating a place in the lake to release their eggs. It is suspected that this is happening by the 2 springs or on some exposed gravel shoals on the south west shore (Figure 2). With only a few males present and the lack of any spawning stream, recruitment levels are presumed to be near zero.

Non-game fish

Pothole Lake also supports a population of lake chub. Although not studied intensively, the population was abundant and appear to be healthy. No lake chub were observed in the stomachs of the captured rainbow trout. No new fish species were captured in the small panel (19 mm stretch mesh).

MISCELLANEOUS COMMENTS

1. Photographs of Pothole Lake were taken of some fish species and the surrounding habitat. Most photos were taken to document the change in features over time (i.e. habitat) and are not significant to the relevance of this report on fish stocking. Therefore, these photos are not displayed in this fish stock assessment report but can be viewed at the address indicated at the beginning of this report.

FISH STOCKING PROGRAM

The current rainbow trout stocking program in Pothole Lake appears to be adequate but still requires future investigation to address a few unanswered questions. Understanding the CPUE of anglers would assist with the recommendations to the stocking program. An accurate count of anglers on Pothole Lake is impossible to know with any certainty and a future creel survey may help determine this answer. A winter fishery exists on this lake as well. Future data collection on all of these points will help assist with the stocking recommendations for Pothole Lake.

Another more economical way to determine the CPUE would be to conduct a limited creel survey during high use periods (i.e. long weekends). This survey may be a more cost effective means to obtain CPUE data without having to conduct a full creel survey. Future data collection and anecdotal information received will provide a better idea of the angler use/CPUE and would assist with the future stocking recommendations for Pothole Lake.

From the fish captured in the 2001 survey, there appears to be no evidence of stunting. The condition factor for the 2001 fish was 1.13 (n = 26). These results indicate healthy fish and there appears to be no problem with overpopulation. Three year old fish are reaching lengths as much as 40 cm. Although, it was felt that the gill net and angling CPUE could increase slightly. The gill net CPUE in 1989 was higher than in 2001 and the angling results in 2001 were marginal. Pothole Lake appears that it can support an additional amount of fish stocked each cycle. Therefore, it is recommended to increase the stocking rate by 500 fish (from 1,500 to 2,000). The intent here is to ultimately increase angler CPUE. This stocking number may have to be re-defined in the future once a better understanding of the angler use on Pothole Lake is determined.

The next scheduled assessment for Pothole Lake is recommended to take place in the summer of 2006. By that time, two complete stockings of the increased number of fish will have taken place. In addition, the assessment will coincide with a non stocked year so newly stocked hatchery fish are not captured unnecessarily.

OTHER RECOMMENDATIONS

Understanding the CPUE would assist with future recommendations to the stocking program. While local anglers are targeting Pothole Lake, it is unknown as to the amount of angling use on this lake. The 1989 assessment report suggested that Pothole Lake does not receive much summer use but does receive moderate pressure during the winter as an ice fishery. An accurate count of anglers on Pothole Lake is impossible to know with any certainty although a future creel survey will help answer some of these questions. While on the ground creels can be expensive, another possible solution could be to undertake an aerial boat count survey. This survey was developed by the MWLAP under the Small Lakes Index Management (SLIM) program. This program can be a good indicator of angler use and Pothole Lake would be suitable for this type of angler use survey.

LITERATURE CITED

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Jesson, D.A. 1989. A reconnaissance survey of Pothole Lake No. 1. Peace/Williston Fish and Wildlife Compensation Program Report No. 92. 19pp plus appendices.

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Lake: **Pothole (43 Mile) Lake**

APPENDIX 1

Netting Record

Lake: **Pothole (43 Mile) Lake**

NETTING RECORD **September 24 to 25, 2001**

NETTING SITE #1 Mesh sizes experimental order: 25, 76, 51, 89, 38, 64 mm

Type:	Sinking monofilament gill net		
Date Set:	September 24, 2001	Time:	1445hrs
Date Lifted:	September 25, 2001	Time:	1510 hrs
Net Dimensions:	Length: 91.4 m	Depth:	2.4 m
Shallow End Mesh Size:	25 mm	Depth: Substrate:	0.8 m aquatic plants/SWD
Deep End Mesh Size:	64 mm	Depth: Substrate:	17.0 m unknown

Comments:

Net was set overnight. Net was pulled at 0930 hrs on September 25; produced 17 lake chub and 18 rainbow trout. Net was reset and pulled again at 1510; no fish caught this time (1 RB escaped as net was pulled). Gill net #1 produced 18 RB.

NETTING SITE #2 Mesh sizes (1 panel): 19 mm

Type:	Sinking monofilament gill net		
Date Set:	September 24, 2001	Time:	1055 hrs
Date Lifted:	September 25, 2001	Time:	1145 hrs
Net Dimensions:	Length: 15.24 m	Depth:	2.4 m
Shallow End Mesh Size:	19 mm	Depth: Substrate:	21 to 24 m unknown
Deep End Mesh Size:	19 mm	Depth: Substrate:	21 to 24 m unknown

Comments:

Net was set overnight and pulled the next morning. No fish were caught.

Lake: **Pothole (43 Mile) Lake**

NETTING RECORD **September 25, 2001**

NETTING SITE # 3 Mesh sizes experimental order: 25, 76, 51, 89, 38, 64 mm

Type:	Sinking monofilament gill net		
Date Set:	September 25, 2001	Time:	1000 hrs
Date Lifted:	September 25, 2001	Time:	1430 hrs
Net Dimensions:	Length: 91.4 m	Depth:	2.4 m
Shallow End Mesh Size:	25 mm	Depth:	0.7 m
		Substrate:	organics/ aquatic plants
Deep End Mesh Size:	64 mm	Depth:	14.0 m
		Substrate:	unknown

Comments:

Net was set during the day and was left to fish for 4.5 hours. Net was pulled at 1430. Gill net #3 produced 7 RB.

Lake: **Pothole (43 Mile) Lake**

APPENDIX 2

Individual Fish Data

Lake: **Pothole (43 Mile) Lake**

INDIVIDUAL FISH DATA

Date Captured: September 25, 2001
Gill Net # 1

M - Male, F - Female, ? - Not Obvious
IMM - Immature, MG - Maturing, MT - Mature, GV - Gravid, SP - Spent, ? - Not Obvious
EG - Egg, ML - Milt, HD - Head, TG - Fish Tag, ST - Stomach
SC - Scale, FR - Fin Ray, OT - Otolith, WF - Whole Fish

Method of Capture: Sinking monofilament gill net.
Condition Factor (K) = $W / L^3 \times 100$

Species	Fork Length (cm)	Weight (grams)	Condition Factor	Gonadal Maturity	Sex	Sample Type	Age (yrs)	Stomach Contents				Comments
								Plankton	Insects	Fish	Other	
RB	38.9	706.0	1.20	MG	F	SC	3	zooplankton	worms			not spawnbound
RB	43.6	901.0	1.09	MG	F	SC	5	zooplankton				not spawnbound; empty
RB	43.2	917.0	1.14	MG	F	SC	5		lots green worms			not spawnbound; full
RB	39.5	697.0	1.13	MG	F	SC	3	zooplankton				empty
RB	44.7	1011	1.13	MG	F	SC	5	zooplankton	green worms		detritus	full
RB	43.4	820.0	1.00	MG	F	SC	5	zooplankton	worms	shrimp		tapeworms
RB	43.3	874.0	1.08	MG	F	SC	5	zooplankton green		shrimp		
RB	41.1	859.0	1.24	MG	F	SC	5	zooplankton green				full
RB	42.2	1009	1.34	Full of eggs	F	SC	5	zooplankton		clam		spawnbound with next yrs. Eggs
RB	40.5	769.0	1.16	MG	F	SC	3	zooplankton				too digested
RB	38.0	613.0	1.12	Full of eggs	F	SC	3	zooplankton	green worms	shrimp		spawnbound, no 2nd eggs
RB	12.5	23.0	1.18	IMM	F	SC	1					unknown
RB	13.1	25.0	1.11	IMM	F	SC	1	zooplankton	winged insect			
RB	41.0	863.0	1.25	MG	F	SC	5	zooplankton				tapeworms
RB	38.6	678.0	1.18	MG	F	SC	3	zooplankton green				tapeworms; full
RB	43.8	811.0	0.97	Red	M	SC	5		green worms			looks spawnbound
RB	42.9	762.0	0.97	MG	M	SC	5	zooplankton	worms			small testes; looks red; empty
RB	39.7	653.0	1.04	MG	M	SC	3	zooplankton		clams	detritus	

Ch. chaoborus
Cl. clams
G. gammarus
Le. leeches
P.M. phantom midge
O.M. organic matter
L. lice
T.W. tapeworms
S. snails
M. mayflies (general)
Da. daphnia
Di. diptera
Ca. callibaetis

Lake: **Pothole (43 Mile) Lake**

INDIVIDUAL FISH DATA

Date Captured: September 25, 2001
Gee trap # 2 + Gill Net # 3

M - Male
F - Female
? - Not Obvious

IMM - Immature
MG - Maturing
MT - Mature
GV - Gravid
SP - Spent
? - Not Obvious

EG - Egg
ML - Milt
HD - Head
TG - Fish Tag
ST - Stomach

SC - Scale
FR - Fin Ray
OT - Otolith
WF - Whole Fish

Method of Capture: Sinking monofilament gill net.
Condition Factor (K) = $W / L^3 \times 100$

Species	Fork Length (cm)	Weight (grams)	Condition Factor	Gonadal Maturity	Sex	Sample Type	Age (yrs)	Stomach Contents				Comments
								Plankton	Insects	Fish	Other	
RB	12.0	17.0	0.98	IMM	F	SC	1					Gee trap # 2; empty
RB	41.3	870	1.24	MG	F	SC	5	zooplankton	insects			
RB	40.8	812	1.20	MG	F	SC	3	zooplankton	green worms	shrimp		full stomach; tapeworms
RB	44.5	944	1.07	MG	F	SC	5	zooplankton	green worms	shrimp		full stomach
RB	42.8	951	1.21	Full of eggs	F	SC	5	zooplankton	green worms	shrimp		spawnbound with 2nd set of eggs
RB	41.0	789	1.14	MG	F	SC	5		green worms		detritus	
RB	40.0	750	1.17	MG	F	SC	5	zooplankton	winged insect		detritus	
RB	38.2	548	0.98	SP	F	SC	3	zooplankton		shrimp		24 eggs left over; 2nd set eggs developing; alternate yr spawner

Ch.	chaoborus	P.M.	phantom midge	T.W.	tapeworms	Da.	daphnia
Cl.	clams	O.M.	organic matter	S.	snails	Di.	diptera
G.	gammarus	L.	lice	M.	mayflies (general)	Ca.	callibaetis
Le.	leeches						

Lake: **Pothole (43 Mile) Lake**

AGE DETERMINATION

COMPLETED BY:

North/South Consultants
83 Scurfield Blvd.
Don Macdonel and Paul Graveline
Winnipeg, Manitoba, R3T 1G4

and

Arne Langston
Peace/Williston Fish and Wildlife Compensation Program
1011, 4th Ave.
Prince George, BC V2L 3H9